SUB-POISSONIAN AND
SUPER-POISSONIAN SHOT NOISE
IN PLANAR COLD CATHODES

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The onset of current self-quenching due to the space-charge built-up in the vacuum gap between cathode and anode leads to shot noise reduction in the anode current of thermionic cathodes. This effect has been analyzed extensively by several authors using analytical and computational techniques [1, 2]. In recently proposed cold cathode structures, the energy distribution of the injected electron beam into vacuum can be quite different from the hemi-Maxwellian distribution typical of thermionic cathodes. We have used an Ensemble Monte-Carlo technique [3] to study shot noise in planar cold catghodes in which the emission into vacuum is characterized by an average injection energy far in excess to the thermal energy typical in thermionic cathodes. Biasing conditions and cathode parameters are found for which the low frequency shot noise power spectrum exceeds the Schottky classical result. It is shown that the shot noise enhancement is due to large fluctuations in both energy and space of the maximum of the energy potential hump in front of the cathode.

Acknowledgment

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References

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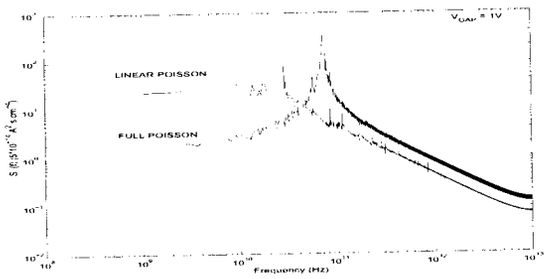

Figure 1: Frequency dependence of the spectral density $S_I(f)$ of the current density fluctuations for a Au/CdS/LaS cold cathode. The curves labeled **LINEAR** and **FULL** Poisson correspond to EMC simulations using a linear potential drop across the vacuum gap or a full self-consistent solution of Poisson's equation, respectively.

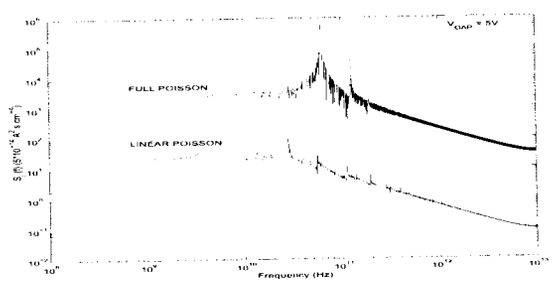

Figure 2: Same as Fig.1 for a bias across the vacuum gap $V_{gap} = 5$V.